

ChE 4063 Chemical Reactor Design

Required course for ChE program

Catalog Description: Application of the rates of homogeneous and heterogeneous reactions to the design and the engineering evaluation of chemical reactors.

Prerequisites: ChE 3084.

Corequisites: n/a

Prerequisites by Topic: Material and energy balances, fluid mechanics, heat transfer, mass transfer, differential equations (ES 3053, ChE 2003, ES 3003, ES 3073, ChE 3084, Math 3073)

Recent Textbook: Octave Levenspiel's *Chemical Reaction Engineering*, 3rd Edition, John Wiley & Sons (1999)

Other Required Material: None

Course Objectives: At the end of the course, students will be able to:

1. Design ideal isothermal reactors, including cases with changes in pressure and density
2. Analyze kinetic data for concentration and temperature dependence
3. Size simple cases of non-isothermal, ideal reactors analytically
4. Size ideal reactors for complex cases using modern computing tools as appropriate including multiple reactions in non-isothermal reactors
5. Explain the principles of catalysis and kinetics of catalytic reactions.

Major Topics Covered in the Course: Conversion and stoichiometric relationships, chemical kinetics, isothermal reactor design, analysis of rate data, non-isothermal reactor design, HYSYS methods, design project, multiple reactions, catalysis and catalytic reactors, diffusion and reaction in porous catalysts, non-ideal reactors.

Class/Laboratory Schedule: Lecture sessions meet for two 75-minute session each week for 14 weeks.

Professional Component Contribution: This is an engineering science/design course.

Relationship to Student Outcomes	
outcomes:	Description of related course content:
(a) an ability to apply knowledge of mathematics, science and engineering	Students learn the theory and basic equations behind reactor design
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	Students are required to analyze and interpret chemical reaction data to determine reaction order and temperature dependence
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	Students spend approximately half the course on design-related topics, including reactor design assignments and a semester design project

Relationship to Student Outcomes	
(d) an ability to function on multi-disciplinary teams	
(e) an ability to identify, formulate, and solve engineering problems	Class discussions and the design project focused on finding the necessary information to solve a real engineering problem
(f) an understanding of professional and ethical responsibility	
(g) an ability to communicate effectively	
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	
(i) a recognition of the need for, and an ability to engage in life-long learning	
(j) a knowledge of contemporary issues	
(k) an ability to use the techniques, skills and modern engineering tools necessary for engineering practice	Students are required to use computers to solve problems throughout the course. Excel and HYSYS are required.

Modified 5/3/07 by GLP for FSM as per faculty meeting changes made 4/26/07

Modified by Christi L Patton, April 28, 2008

Course objectives from Spring 2009 added by G. L. Price

Modified 3/20/2012 to remove old ChE criteria - GLP